

Summary of Evaluation Results

1. Outline of the Project	
Country: Socialist Republic of Viet Nam	Project Title: The Project for the Development of Crop Genotypes for the Midlands and Mountain Areas of North Viet Nam
Sector: Agriculture and Rural Development	Cooperation Scheme: Technical Cooperation Project (SATREPS)
Division in charge: Rural Development Department,	Total Cost: 3.8 hundred million yen (at the time of evaluation):
Period of Cooperation (R/D): December 3, 2010- December 2, 2015 (5 years)	Partner Country's Implementing Organization: Vietnam National University of Agriculture (VNUA) (Former Hanoi University of Agriculture (HUA))
	Supporting Organization in Japan: - Faculty of Agriculture, Kyushu University - Institute of Tropical Agriculture, Kyushu University; - Bioscience and Biotechnology Center, Nagoya University
<p>1-1. Background of the Project</p> <p>As Viet Nam has been industrializing after Doi Moi Policy, share of agriculture sector has been decreased in terms of its employment population (from 70% to 50%) and gross domestic products (from 40% to 20%). However, absolute scale of agriculture production has been expanded with expansion of the national economy; thus, agriculture is still one of major economic sectors in Vietnam. In particular, rice is a staple food for Vietnamese and nearly 6 million tons are exported for earning foreign exchanges. In addition, since soil erosion and water shortage caused by deforestation as well as floods and drought frequently occurred in recent years, and led to decrease in yields of crops, ensuring food security is listed in the prioritized government development policy. Major agricultural crops including rice are mainly produced in plain areas of Mekong Delta and Red River Delta. On the other hand, in the midlands and mountain areas of North Vietnam as the target area of the Project, as rice cropping could be implemented only once a year for 40% of the area and agricultural infrastructure have not been fully developed, agricultural productivity and self-sufficient rate of rice remain at low level, which have impeded poverty reduction, stabilities, and development of the area. In order to increase agricultural productivity in the area, development of new rice breeds with short growth duration, high yielding, and disease and insect resistance as well as their dissemination are urgently required.</p> <p>Government research institutes and universities in Vietnam including HUA have worked on rice breeding technologies and have so far brought certain level of results. Since these technologies are conventional ones mainly with hybridization and selection, it takes time to develop new rice breeds. Thus, it is required for them to undertake breeding efficiently by introducing advanced breeding technologies with using genetic code. On the other hand, academic results on rice breeding in Japan have not necessarily been applied for actual practices in other counties. Considering these situations both in Vietnam and Japan, the record of discussion (R/D) on five-year technical cooperation project for developing promising lines with useful genes was signed between among concerned authorities of both countries in October 2010.</p> <p>In July 2013, since the Project reached the halfway point of its implementation period, JICA and</p>	

Vietnamese authorities concerned jointly conducted the Mid-term Review of the Project, as stipulated in the Record of Discussion (R/D) signed in August 2010.

In August 2015, about six months prior to the completion of the cooperation period of the Project, JICA dispatched Terminal Evaluation Team, headed by Mr. Tomochika MOTOMURA, to conduct the Terminal Evaluation jointly with the Vietnamese members and provide recommendations on the actions to be taken during the remaining cooperation period to secure the sustainability of the Project, as well as drawing lessons useful for technical cooperation schemes in general.

1-2. Project Overview

- (1) Overall Goal: Food security is improved and sustainable rural development is progressed by disseminating improved rice varieties.
- (2) Project Purpose: Rice breeding system is strengthened to develop promising lines adapting for natural and socio-economic conditions in the midlands and mountain areas of North Viet Nam.

(3) Outputs:

Output 1: Breeding method is improved using high-throughput genotyping technology.

Output 2: Promising lines with short growth duration, high yielding, and disease and insect resistance are developed.

Output 3: Eco-physiology of promising lines is characterized.

(4) Inputs (at the time of evaluation (2015.8))

Japanese Side

Dispatch of Experts: Thirteen (13) short-term experts/researchers and one long-term expert (Project Coordinator) were dispatched as of the 7th of August 2015.

Provision of Equipment: Approximately USD 1.59 million.

Local Cost: Approximately USD 1.9 million until the end of March 2015.

Vietnamese Side

Allocation of CPs: 42 (Project Director, Project Manager and 40 researchers)

Land and Facility: Project office, laboratories, net houses, and experimental paddy field in VNUA. Expenses for land lease of experimental paddy fields in Thai Nguyen and Lao Cai, and of paddy field for Soc Trang Breeding Station were shared between VNUA and the Japanese side.

Operation Cost: Around USD 0.38 million spent by the end of March 2015.

2. Evaluation Team

Team Members

Japanese Side

- (1) Mr. Motochika MOTOMURA (Leader), Senior Advisor to the Director General, JICA
- (2) Ms. Miki OTSUKA (Cooperation Planning), Agricultural and Rural Development Group 1, Team 1, Rural Development Department, JICA
- (3) Dr. Hideaki HIGASHINO (Evaluation Analysis), Senior Consultant, RECS International Inc.

<p>(4) Dr. Makie KOKUBUN* Program Officer, Science and Technology Research Partnership for Sustainable Development (SATREPS), Japan Science and Technology Agency (JST), Professor Emeritus, Tohoku University</p> <p>(5) Dr. Ken-Suke KODAIRA* Assistant Program Office Department of International Affairs</p> <p>*:Observer</p>	
<p>Vietnamese Side</p> <p>(1) Dr. Vu Van Liet (Leader) Director, Crops Research and Development Institute (CRDI), VNUA</p> <p>(2) Dr. La Tuan Nghia (Member) Director General, National Plant Resources Center, Ministry of Agriculture and Rural Development (MARD)</p>	
<p>Period of Evaluation: July 20-August 7, 2015</p>	<p>Type of Evaluation: Terminal Evaluation</p>
<p>3. Results of Evaluation</p>	
<p>3-1. Project Performances</p> <p>(1) Summary of Project Purpose Achievements</p> <p><i>Project Purpose: Rice breeding system is strengthened to develop promising lines adapting for natural and socio-economic conditions in the midlands and mountain areas of North Viet Nam.</i></p> <p><i>Verifiable Indicators: The number of promising lines for the new variety of rice with the following traits (target: at least 2 or 3 lines)</i></p> <p>- Achieved (4 promising lines: DCG19, DCG31, DCG66, DCG72)</p>	
<p>a) Growing duration is shortened by 10 days (current averaging growing duration is 100-110 days in autumn and 115-125 days in spring season</p>	<p>Achieved.</p> <p>- Assuming that the average growing duration is 105 for autumn, and 120 for spring season, growing duration of DCG72 is more than 10 days shorter than that of KD18</p>
<p>b) Yield increases by 5-10% compared with the popular (check) variety in the Project area (midland and mountain area = Thai Nguyen and Lao Cai) *to compare figures measured at experimental fields</p>	<p>Nearly achieved.</p> <p>- In autumn cropping of 2014, lines with genes for high yielding (<i>GNI</i> and <i>WFPI</i>) showed increase the number of kernels. However, the grain yield did not increase. In 2015 spring season cropping, focusing on lines with <i>WFPI</i>, to improve the balance between the source and sink capacities, a study has been under progress in terms of effects of nitrogen application (e.g. additional fertilization) on yield and physiological characteristics. The interim results of the test at July 2015 indicate that change of nitrogen application (timing and amount) could improve grain yields of DCG36.</p>
<p>c) Resistance against insect/disease was introduced</p>	<p>Almost achieved.</p> <p>- As shown in the table below, it was verified that lines with <i>XA7</i> and/or <i>XA21</i> have resistance against Bacterial Blight Resistance.</p>

	Lines	Lesion Length (Bacterial Leaf Blight)
	KD18	16-18cm
	With <i>XA7</i>	0.3-0.5cm
	With <i>XA21</i>	6-14cm
	With <i>XA7 + XA21</i>	0.2-0.5cm
	<ul style="list-style-type: none"> - As for the resistance against insects, promising lines (NILs) with planthopper resistance genes (<i>BPH25</i> and <i>BPH26</i>), will be evaluated against insect population in North Viet Nam in September 2015 in Japan (Kyushu Okinawa Agricultural Research Center). - Effectiveness of <i>OVC</i> in terms of resistance against planthopper was verified at VNUA by visually observing water soaking lesions on the plant stems of tested promising lines. 	

(2) Summary of Outputs Achievements

Output 1: Breeding method is improved using high-throughput genotyping technology.	
Indicator 1-1: The number of genetic resources collected at VNUA (target: 200 lines).	<ul style="list-style-type: none"> - Fully achieved. - Kyushu and Nagoya Univ. introduced 186 genetic resources to VNUA from 2010 to 2011. - Utilizing the introduced resources, 42 genetic resources carrying useful traits were developed at VNUA until 2015. - The total reached 228 as of July 2015.
Indicator 1-2: The number of useful genes x the number of genetic backgrounds applicable for high-throughput genotyping (target: 20 genes).	<ul style="list-style-type: none"> - Fully achieved. - A high-throughput genotyping system was introduced to VNUA in July 2012. - As of July 2015, a total of 16 genes applicable for the high-throughput genotyping system with two genetic backgrounds (IR24 and KD18) were identified (16x 2 =32).
Indicator 1-3-1: The total number of lines which were generation-advanced (target: 960 lines).	<ul style="list-style-type: none"> - Fully achieved. - The total number of lines that were generation advanced reached 1,366 as of July 2015.
Indicator 1-3-2: The total number of lines which were planted in Soc Tran (target: 96 lines/year)	<ul style="list-style-type: none"> - Fully achieved. - The total number of lines planted in Soc Tran reached 906 lines (181.2 lines/per year).
Output 2: Promising lines with short growth duration, high yielding, and disease and insect resistance are developed.	

Indicator 2-1: The number of developed promising lines with single useful genes (target: 20 lines).	<ul style="list-style-type: none"> - Fully achieved. - The number of developed promising lines with single useful genes (NILs) was 20 as of July 2015.
Indicator 2-2: The number of developed promising lines with accumulated genes (target: 30 lines).	<ul style="list-style-type: none"> - Fully achieved. - The number of developed lines with accumulated lines (PYLs) was 30 as of July 2015.
Indicator 2-3: The number of tested lines (target: 160 lines).	<ul style="list-style-type: none"> - Fully achieved. - The number of tested lines was 445 as of July 2015.
Output 3: Eco-physiology of promising lines is characterized.	
Indicator 3-1: The number of lines for which physiological tests were conducted (target: 10 lines).	<ul style="list-style-type: none"> - Nearly achieved. - The number of lines for which physiological tests were conducted reached 9 as of July 2015.
Indicator 3-2: The number of promising lines and sites (target: 3 sites = midland, mountain area and Red River delta) for which ecological adaptability test was conducted (target: 10 lines).	<ul style="list-style-type: none"> - Fully achieved. - Ecological adaptability tests for 12 lines have been conducted up to July 2015 were conducted in 3 sites (Thai Nguyen, Lao Cai, and Hanoi).
Indicator 3-3: The number of developed guideline for cultivation for newly developed promising lines (target: 4 guidelines).	<ul style="list-style-type: none"> - Fully achieved. - Six guidelines for Thai Nguyen and Lao Cai provinces in spring and autumn cropping seasons have been developed for cultivation of newly developed promising lines (DCG19, DCG31, DCG 66 and DCG 72) as follows:

3-2 Summary of Terminal Evaluation Results

Evaluation results based on 5 evaluation criteria are as follows:

(1) Relevance: High

The Project was evaluated as highly relevant with Vietnamese development policy, Japan's aid policy and strategy, the needs of VNUA and target areas, at the time of Terminal Evaluation.

(2) Effectiveness: High

During the Project Period, research environment in the field of rice breeding at VNUA was significantly strengthened through provision of various laboratory equipment and support to the renovation and construction of facilities by the Japanese side. Accumulation of useful genetic resources, and capacity enhancement of young Vietnamese C/Ps through trainings and collaborative research works with Japanese experts laid the basis to further strengthen the system to develop promising lines adapting for natural and socio-economic conditions in the midlands and mountain areas of North Viet Nam. The verifiable indicators

of the Project Purpose were mostly satisfied.

(3) Efficiency: Relatively High

Inputs were appropriately made overall, and contributed to implementing activities and generating Outputs. Expenditure necessary for Project activities (e.g. experiment and personnel cost) has been disbursed with a timely manner. Provided equipment has been fully utilized so far, and led to smooth implementation of various activities and achievements of outputs. Meanwhile, it was figured out that one of the major items in provided equipment would not be effectively operational after 2017 due to discontinuation of technical supports and sales of test reagents by the manufacturer. Vietnamese C/Ps, most of whom are lecturers and have duties to give lectures could not spend sufficient time on the Project activities. These facts slightly lowered the Efficiency.

(4) Impact: High

It is expected developed promising lines will be officially registered as new varieties in the first half of 2016. Trial cultivation of these promising lines is conducted in Thai Nguyen and Lao Cai provinces.

For disseminating improved rice varieties, collaboration with seed companies and farmers is essential. However, VNUA has already established collaborative relation with a seed joint-stock company in Thai Nguyen and the seed center in Lao Cai through operation of the experimental paddy fields.

Judging from these facts, preconditions to achieve Overall Goal have been satisfied and it is highly expected that Overall Goal will be achieved in the future. In addition, various positive impacts are observed.

(5) Sustainability: Moderate

Sustainability of the Project is considered relatively high as concerns remain as regards financial sustainability. In June 2015, VNUA was put under experimental operational reform from 2015 to 2017, in which annual budget from the government will decrease in a step-by-step manner. Shortly after the announcement, International Center of Plant Research, Japan/Viet Nam (CIPR), a financially independent organization, was established by integrating Plant Breeding Laboratory and Plant Production Physiology Laboratory of VNUA that have played a leading role in the Project activities during the past four and a half years. As a financially independent organization, CIPR needs to secure budget to cover the running cost through submitting research proposals to fund resource organizations such as MARD, MOET, MOST, as well as international donor organizations like JICA.

3-3. Factors promoting the production of effects

3-3-1. Factors pertaining to planning

No particular factors pertaining to planning were recognized.

3-3-2. Factors pertaining to the implementation process

(1) Good collaborative relations between Japanese Experts and Vietnamese C/Ps that have facilitated research activities and generated results as expected.

(2) Good relationship among C/P members of VNUA: Young researchers assigned as C/Ps implemented research activities of the Project receiving advice not only from Japanese Experts but from senior Vietnamese C/Ps.

(3) Cooperation from Soc Trang provincial government: Soc Trang Rice Breeding Station was established about a half year earlier than planned. Generation acceleration with back-crossing has been rapidly practiced.

3-4. Factors inhibiting the production of effects

3-4-1. Factors pertaining to planning

(1) No particular factors pertaining to planning were recognized.

3-4-2. Factors pertaining to the implementation process

No particular factors pertaining to planning were recognized.

3-5. Conclusion

In general, the Project has been smoothly implemented based on the Project Design Matrix especially after the amendments. Almost all activities have been completed, and the Project achieved sufficient level of Outputs as planned, some of which have exceeded the originally targeted one. As a result, Project Purpose has been nearly achieved.

Although there remain issues especially on sustainability after the Project completion, the Joint Evaluation Team acknowledged that VNUA (specifically CIPR) has enough capabilities (well-skilled human resources, promising lines and databased genetic resources, advanced equipment and facilities, etc.) to address these issues.

Therefore, the Joint Evaluation Team anticipates that the Project will be fully achieved by the termination of the cooperation period, and it is appropriate to finish the Project in December 2015 as scheduled.

3-6. Recommendations (Details are in the Chapter 5 of the Joint Evaluation Report)

3-6-1. Recommended Actions to be taken by the Project Team in the Remaining Period

(1) Development of promising lines with short growth duration, high yielding, and disease and insect resistance has already been achieved, on the other hand, several candidate lines remain to be developed through MAS. In order for Vietnamese side to continue the MAS breeding, it is necessary to complete the database of promising lines and the genetic resources within the Project period.

(2) It is necessary for the Project Team to preserve the genetic resources and lines developed by the Project, which will be used as breeding materials in the future. Therefore, the backup storage system for those resources should be established during the Project period to reduce the risk of the loss or deterioration of the materials, as well as the necessary legal arrangement including material transfer and utilization.

3-6-2. Recommendations to the Japanese Side (After the Project)

In the Project, the Vietnamese side has acquired the necessary skills of genomic breeding by utilizing DNA markers. In order for the Center of International Plant Research Vietnam/Japan (CIPR) to play the pivotal role in ASEAN in the field of genomic breeding, the Japanese research institutes are expected to strengthen the research network with the Vietnamese side for further collaboration.

3-6-3. Recommendations to the Vietnamese Side (After the Project)

(1) Since the majority of the operational expenditures have been covered by the Project, it would be crucial

for the Vietnamese side to secure the necessary budget for continuing the project-related research activities such as the cost for the employment of the staff, the maintenance of the machinery, and the purchase of the necessary experimental consumables.

Although some students received trainings in Japan for research proposal and budget management after the mid-term review, it is still difficult for the younger researchers to obtain adequate budget for the research activities. Therefore, CIPR members are requested to make continuous efforts to develop their capacity for research proposals to possible funding sources.

(2) In the Project, the MAS breeding technology could effectively have developed the promising lines with the disease and insect resistance genes, which are valuable property for Viet Nam and need continuous development and utilization in the future.

When these promising lines are to be introduced into the crop fields in the future, careful deployment of these lines is necessary with the cooperation with plant protection section who can monitor the virulence of disease and insects, given the possibility that a newly-released genotype might trigger the occurrence of unexpected mutation of those pests which might nullify the resistance.

3-7. Lessons Learned

3-7-1. Key Factors for Success

The key factor for success of the Project is attributed to the synergetic combination of the cutting edge technology of the Japanese side (MAS, etc.), generation- acceleration system of the Vietnamese side, through the effective exploitation of diverse natural environment in Viet Nam.

Another primary factor for success derives from the solid relationship between the Vietnamese side and Kyusyu University, which has been built through past joint-research projects and student exchange programs. This synergetic combination and solid relationship with C/P institutes were confirmed to be primary factors for the success of the collaboration, which are prerequisites for future SATREPS project formulation.

3-7-2. Careful Selection of Equipment

DNA Genotyping System of Illumina (VC-101-1000J) was provided to VNUA, as it had been regarded as the best system when the Project was planned in 2010.

However, this system was found to be under insufficient utilization currently due to lack of enough number of well- trained operators and adequate operational costs, even though the Project has tackled this issue by providing further training opportunities to C/Ps during the Project period.

In addition, Illumina Inc. decided to discontinue production and sale of test reagents in October 2012 and they will be available only until 2017, which was unexpected when the Project was launched.

For future SATREPS projects, it is important to introduce appropriate technology depending on the progress of the Project, taking considerations on the conditions for research implementation (availability of chemicals, technical support, power supply, research implementation capability, etc.).

3-7-3. Information Sharing

It is significant for the Project team to successfully facilitate information sharing among concerned persons through weekly news published both in Japanese and English which includes information not only on scientific activities but on cultural aspects of the Japanese and Vietnamese sides. This weekly news has

been open to the public through the JICA Website, which served to disseminate the activities of the Project. This is a good practice which can be applied to future SATREPS projects.